

Verification of counterfeiting seal impressions made by photo-electric automatic engraving and photosetting methods

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Abstract

Seals have been existed in Chinese history for over two thousand years and are still using today. There are numerous ways to create and use Chinese seals for fraudulent purposes. This paper presents an overview of the possible production ways of manufacturing seals using new technologies and tries to prove whether these production methods can eliminate the classical characteristics an examiner is looking for in the comparison of a reproduced seal impression to that of the original seal. It is proved that the conventional verification methods for Chinese seal impressions are still effective.

Keywords: *Chinese seals, photopolymer, overlay check, reproduced seal impression, zinc plate seal, hand engraving*

Introduction

Chinese seals have been used in China for over two thousand years. Seals in Chinese society have two-fold meanings: one for personal identity and the other for arts. Though signatures play significant roles for personal identity, seals are even more important in history. Other usages of imprints of seals such as signing commercial contracts, doing business transactions and interchanging governmental documents are also needed in Chinese society.

When a person needs a seal, he usually goes to a seal manufacturing shop. The shop uses several ways to manufacture seals: by hand-craft, machine-craft and photopolymer craft. It takes the same way for someone to reproduce a counterfeit seal for fraudulent purposes unless he is associated with more sophisticated manufacturing technologies. Seals made by the three mentioned methods are considered to be individualized

through the manufacturing process as well as accidental uses or wear on the original seals[1-4]. In the past two decades, with the advent of desktop publishing, or with new developments of photosetting machines such as ‘Silhouette Mint Custom Stamp Maker’, one may use this kind of ready-made machine to produce seals of his own at home. Even writing or signatures can be scanned into a computer using any of the commercial graphic software programs [5].

Document examiners are familiar with the production techniques used in the past in which seal impressions are made by hand-craft, machine-craft and pressing. Errors in the manufacturing processes play a role in the identification of such due to misalignment, application of cutting force, foundry type, and improper amount of heat or pressure and so on [6]. In an environment with so many new technological developments, the situation becomes more challenging to today’s document examiners to the identification of

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counterfeiting seal imprints from the genuine ones [7-13].

In order to ease up the situation, the following points should be studied:

1. Reproducing seal impressions by hand-craft: It is assumed that no two seals will leave impressions exactly alike to each other. Therefore, these reproduced seal impressions can definitely be differentiated by human inspection.
2. Reproducing seal impressions by machine-craft: This is a very popular machine-assisted method to produce seals in Chinese society. Most seal manufacturing shops in Taiwan own this kind of machines which are called photoelectric automatic engraver. The automatic engraver has two rotating tables on which a light source and a needle drill are attached. In the procedures of making a seal, the light source and the needle drill firstly aim at each center of the rotating tables, then slowly move outward, and stop until they cover the whole area of the seal impression. The two apparatuses are integrated to the rotating tables and operated synchronously. In the carving processes, a negative film developed from the seal impression is mounted on the table where the light passes through the clear part of the negative, and is blocked at the dark part. A blank wooden rectangular solid is mounted on the other table on which the needle drill will synchronously move up and down and drill the wooden solid as the light passes through and is blocked at the negative accordingly. After the procedures, a reproduced seal is obtained. It is suggested that the apparatuses attached to the two tables of the automatic engraver will not operate as perfect as we wish, and in the automatic engraving procedures, some defects will be left to identifiable inspection.
3. Reproducing seal impressions by photosetting: If you are working with photopolymer, the scanned sealing is printed out and then it is exposed to a negative. After the development, the negative will have a clear outline of the seal impression. You are now ready to produce a photopolymer seal, which is a gel that hardens upon exposure to ultra violet light. The clear area of the negative will allow the UV light passing through and harden the gel. After the hardening is complete, the unexposed areas are washed away to leave the sealing in relief. The procedures in working with the productions of a photosetting seal such as

the time and temperature of water spreading to the plate may lead to the errors which serve as source for identification.

Method

1. A hand-engraved seal designated as the original seal was made by a seal manufacturing shop on the local market street. The seal inked an impression and then the impression played as the standard model to produce the following seals by different producing procedures.
2. Three impressions were prepared from the original seal. One was prepared with thick ink on the seal face and with heavy pressing pressure when pressing the seal on the paper. Another was prepared with normal amount of ink on the seal face and with skewed pressing force to the left. And the other was prepared with normal amount of ink on the seal face and with skewed pressing force to the right. The three impressions were used to compare with the original seal impression.
3. A machine-engraved seal was made by the method of photoelectric engraving. The standard model for the reproduced seal impression was that of the hand-engraving seal. The reproduced impression was used to compare with the original seal impression.
4. A photographic zinc-plate seal was made by the photosetting method. And its impression was used to compare with that of the original seal.
5. A photopolymer seal was made from the impression of the original seal by the photosetting method. Its impression then was used to compare with the original seal impression.
6. The Photoshop software was employed to all reproduced seal impressions with that of the original seal for skeleton comparison. Two images were transferred to the computer and operated by "Photoshop" software program. One image was converted its color from red to cyan and set the image transparency rate to 40%. The other image remained red. Two images were brought together and overlaid one on the other to see if they were matched or not.

Results and discussion

It is assumed that many factors affect the imprint

image from a seal. A softer floor or strong pressing will result in broader lines, thick or excessive ink will give a blurry pattern; damage on seals may result in missing parts in the imprints, other may produce broken lines, etc. Under this circumstance, documents examiners are difficult to make correct conclusion whether the imprints in a case are from the alleged seal or from its reproduction, because the causes affecting the seal impression will hinder the real defects originating from the errors in reproducing impression processes.

The verification ways so far employed by bank clerks and personnel in post offices consist of back and forth comparison and the overlay check of which two images are put together to observe the overlay part. The two half-folded and opposite parts are put together forming a new imprint and the integrity should become one consistent and harmonized image. The two verification methods have been proved effective and correct in the past. Additionally, several computer-assisted verification methods have been studied and introduced by some research institutes and universities; however they are not frequently used by bank clerks or personnel in post offices on their daily transaction duties. They trust and prefer to use the conventional ways with human inspection [14].



Fig. 1 The impression of the original seal.

Fig. 1 shows the original seal impression of which the lines are clear and fine. The structures of the characters representing the name are not well-formed according to the basic structures of the ‘small seal script’

(also named Chin script). The straight and smooth line edges and narrow line widths in the seal impression show that they are the results of sharp-knife cutting.



Fig. 2 Impression obtained from the original seal with excessive ink on the seal face and with heavy pressing pressure.

Three impressions obtained from the original seal in conditions of different ink amount on the seal face, different seal pressing pressure on the paper, and skewed pressing force are prepared to see if they are identical to the original seal impression made in normal way through characteristics comparison and overlay check. One of the three impressions from the original seal shown in Fig. 2 exemplifies an extreme case that the seal impression is prepared in a condition that the seal, with very thick ink on the seal face, pressed heavily on the paper. All lines show very clear marginal zone phenomenon which proves that the ink on the seal face is thick enough to spread to and pile up along the line edges when the seal is pressed heavily on the paper. The stronger pressure and excessive ink result in broader stroke lines of the script, however, the line edges are still straight and smooth. The characteristics comparison to the lines in Fig. 1 and Fig. 2 shows no obvious difference except the blurry area in the center of the character ‘hu’ in Chinese where excessive ink fills in the furrows between lines. From characteristics comparison point of view, these two seal impressions are considered identical.



Fig. 3 Overlay checking to the impression of the original seal and the impression obtained from the original seal with excessive ink on the seal face and with heavy pressing pressure.

From the overlay checking using ‘Photoshop’ software shown in Fig. 3, the two impressions superimpose perfectly to each other. Excessive ink on the seal face and heavy pressing of seal application on the paper do not affect the skeleton of the seal script.

The other two seal impressions from the original seal comparing with the original seal impression shown in Fig. 1 show no difference by characteristics comparison and perfect superimposition by overlay check. They are considered identical to the original seal impression.

The seal impression of Fig. 4 is a reproduced seal impression made by photoelectric engraving method.



Fig.4 Impression of the reproduced seal made by photoelectric automatic engraver.

The characteristics comparison to the lines in Fig. 1 with the respective lines in Fig. 4 exhibits some differences of connections between lines which are supposed to break and also have deformations of line combinations by which the Chinese characters are established and meaningful. The straight line edges in most character strokes in Fig. 4 show that they are the results of needle drilling. But some lines are deformed especially at the corner part of line combinations. The line edges of the outer rectangular frame are much broader than those of the original seal.



Fig. 5 Overlay checking to the impressions of the original seal and the reproduced seal made by photoelectric automatic engraver.

From the overlay checking shown in Fig. 5, the two impressions cannot superimpose to each other. When the two images superimposing the lines perfectly at the upper right character ‘Chen’ in Chinese, you will see very big differences at the rest area of the images. Though the differences are comparatively big, the bank clerks using ordinary overlay checking in such a small impression area around a quadrangular of 1.5cm x 1.5 cm are possibly apt to make wrong conclusion, if they are not assisted by image magnification or Photoshop software. The photo-electric automatic engraver is not performed as perfect as it is thought to be. Big differences arise from the less accurate integration of the light source and needle drill.



Fig. 6 The impression of the reproduced zinc-plate seal.

Fig. 6 is the impression of the reproduced zinc-plate seal. In the manufacturing processes, the area except the harden lines in the film of photosensitive material on top of the zinc plate was erased by corrosive solvent such as diluted water solution of hydro nitric acid. The concentration of the solvent and the application time of corrosion to the zinc plate are critical to seal production. The excessive etching will cause the line edges on the zinc plate zigzagging. The lines in Fig. 6 are not straight and smooth at all than those of the impression of the original seal in Fig. 1. Because the quality of lines is pretty poor, and therefore, the impression exhibits a very blurry character pattern image. Some line combinations are so deformed as to show irregular script pattern. An examiner can easily distinguish the impression of the reproduced zinc plate seal from that of the original seal basing on the different characteristics.

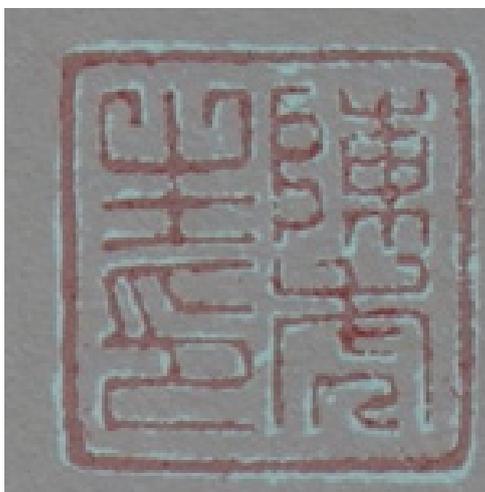


Fig. 7 Overlay checking to the impressions of the original seal and the reproduced zinc plate seal.

Overlay checking to the impressions from the original seal and the reproduced zinc plate seal shows that they are superimposed well, and identical to each other, although the line width of the latter is broader than the former. Etching in the producing procedures does not influence the skeleton of the script pattern. Given these two seal impressions in a case, a document examiner will have difficulty in distinguishing both using overlay check method.

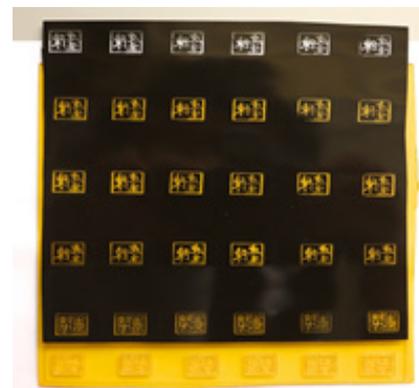


Fig. 8 A photopolymer plate (under) and a negative (upper).

Fig. 8 is the photograph of a photopolymer plate and a negative. It is assumed that according to today's seal production techniques with computer editing and publishing, and the use of photosetting materials, any person can make seals of his own at home. This kind of technology can eliminate those classical identifying characteristics as mentioned, but it needs special attention to every step in the production procedures. Photopolymer production method is considered as one of the high technologies and it renders exquisite reproduced seal impressions.



Fig.9 The impression of the reproduced seal made by the photopolymer method.

After the maker paid extensive care and special attention to the steps of exposing the polymer plate with ultraviolet light through the negative for 95 seconds and washing away the unexposed part of the plate with water for 2.5 minutes in the reproducing procedures, a fine line quality production was then obtained. But when we compared the impression lines of Fig. 9 with those of the original seal, the widths of lines in Fig. 7 were found broader, and the line edges were not as sharp as those cutting with a carving knife or a needle drill. Through special and thorough observation of characteristics between the impressions, it is of no difficulty for bank clerks or examiners to distinguish both and make right decisions.

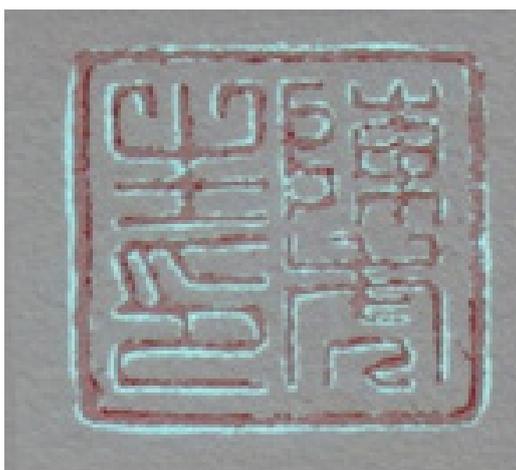


Fig. 10 Overlay checking to the impressions made by the photopolymer method and the original seal.

Overlay checking to the impressions of the seal made by the photopolymer method and the original seal shows these two impressions are identical in Fig. 10. Hardening and washing away with water to photopolymer plate does not influence the skeleton of the script structure. These two impressions cannot be distinguished by overlay check method.

Conclusions

This paper presents one such scenario where an impression of an original hand engraving seal is used to produce three other seals. The three reproduced seals are made by photoelectric automatic engraving, zinc

plate and photopolymer methods. The purpose was to determine whether these reproduced seal impressions can be distinguished from that of the original seal. Conventional verification to seal impression examination and identification are categorized into two ways. One is characteristics inspection and the other overlay check. In this research, the reproduced seal impression made by photoelectric automatic engraver can be identified with both characteristics inspection and overlay check. The impression made by zinc plate method can be identified only by characteristics inspection, but not by overlay check. The impression made by photopolymer method can be identified by characteristics inspection under very special attention, but not by overlay check. This proves that the conventional verification methods for Chinese seal impression identification are still effective.

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